

10/521697

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Applicants : MYKROLIS CORPORATION et al.
International Application No. : PCT/US03/22533
International Filing Date : 18 July 2003
For : FLUID FLOW MEASURING AND PROPORTIONAL FLUID FLOW CONTROL DEVICE

Authorized Officer : Virginia Irby

Attorney
Docket No. : 200200030-PCT

Commissioner for Patents
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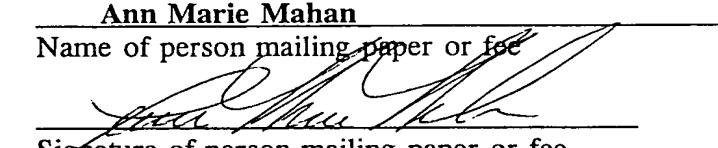
Type of paper : **Formal Drawings (20-sheets)**

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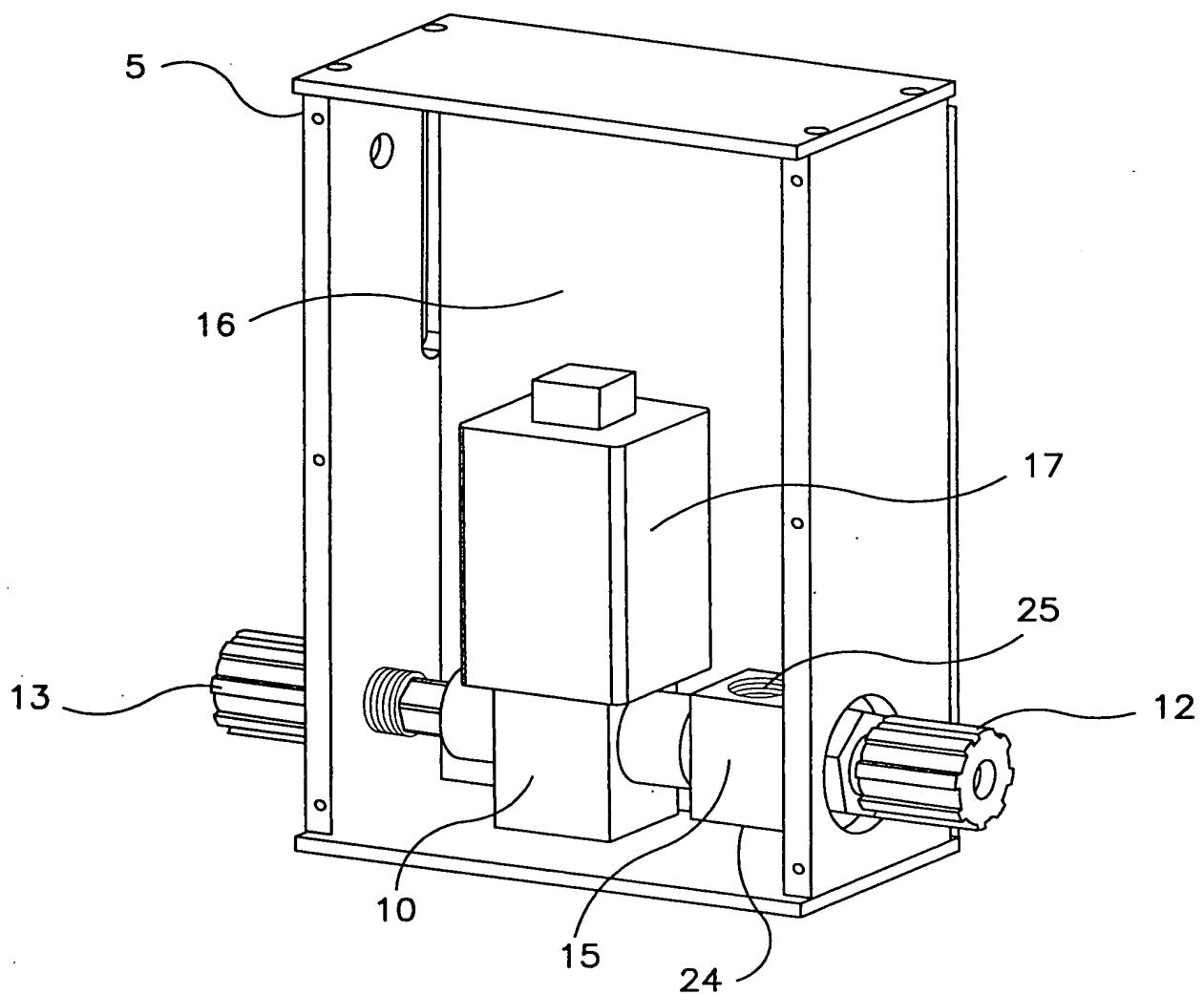


FIG. I

Concentric venturi

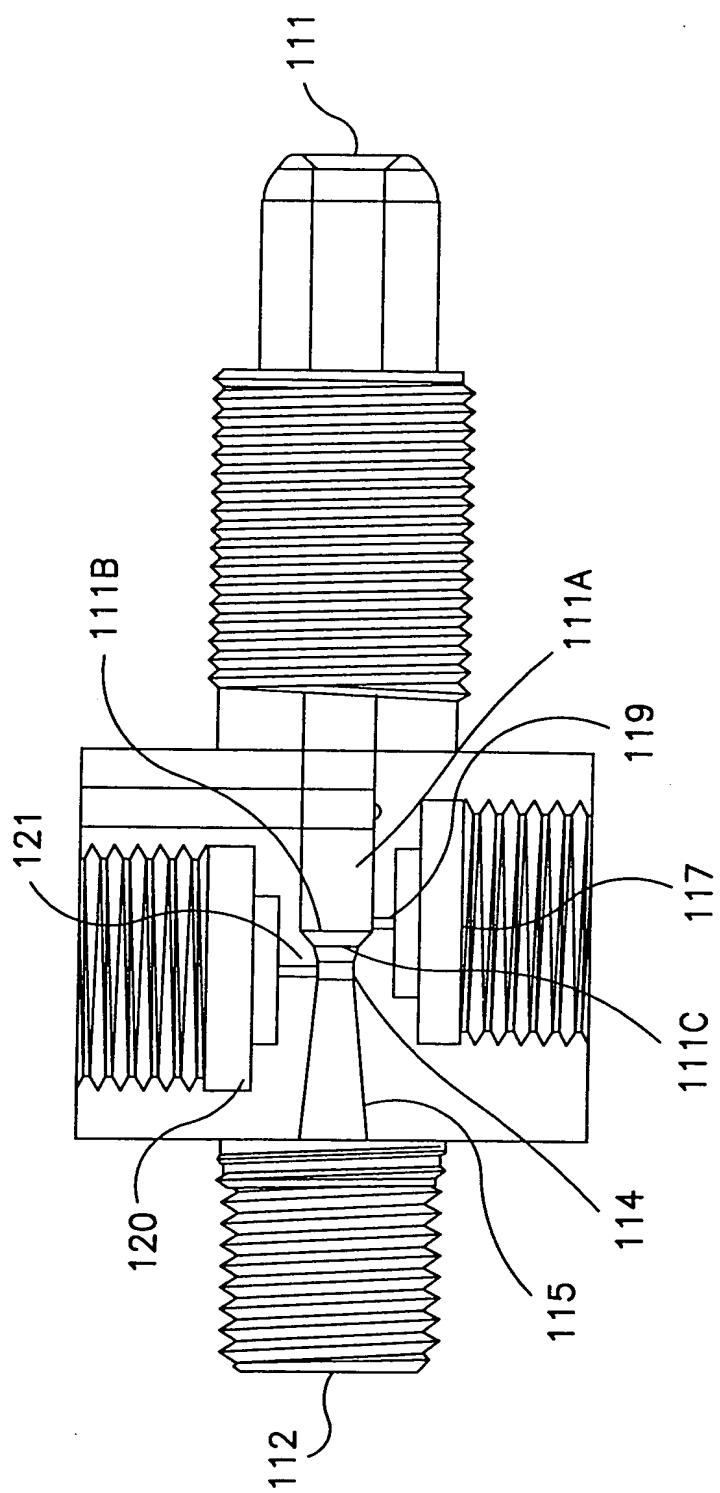


FIG. 2

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Concentric venturi

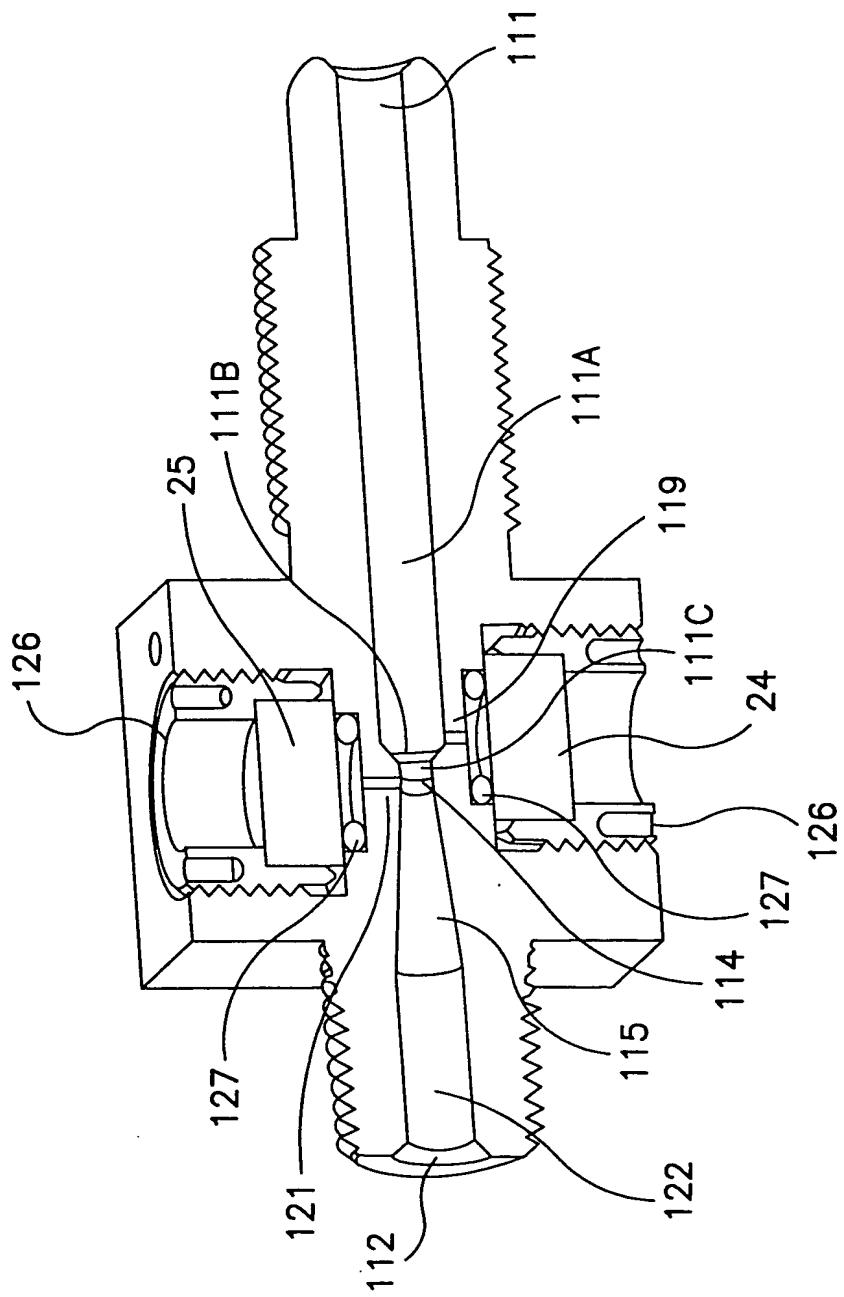
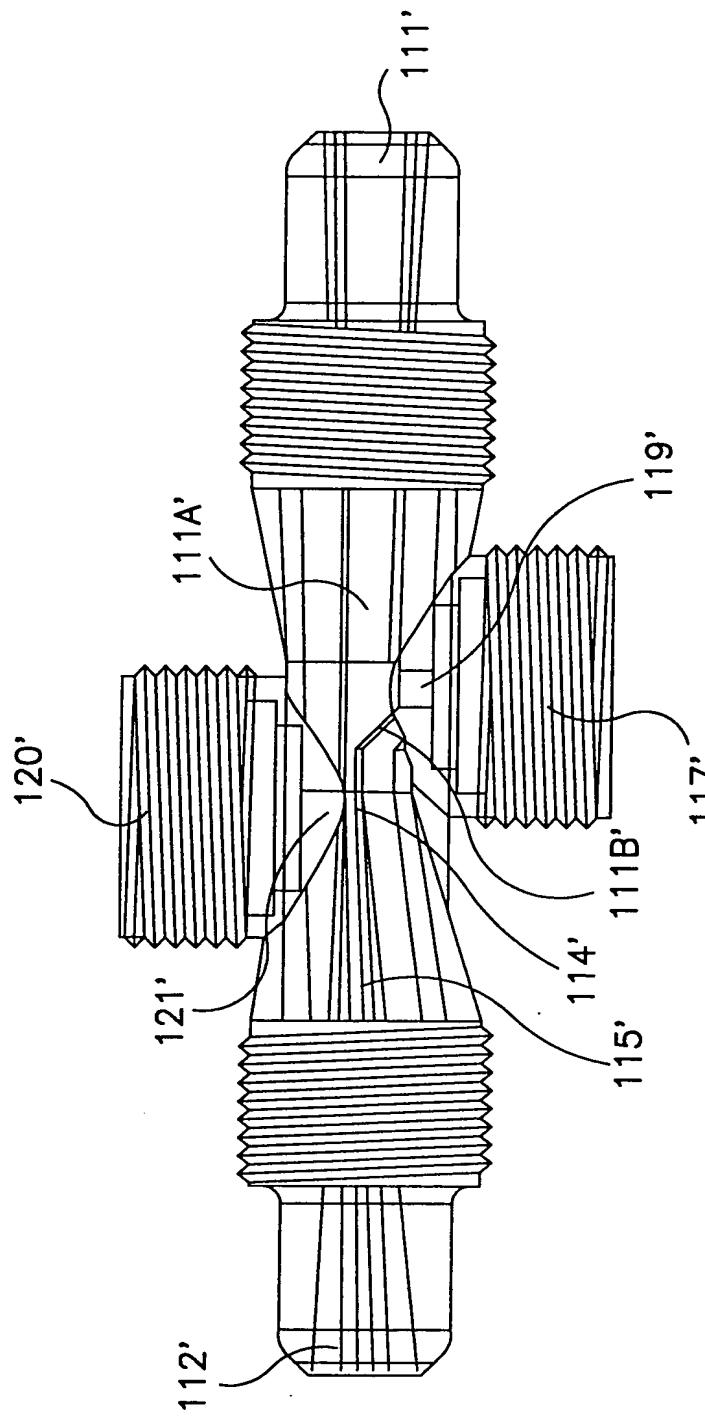


FIG. 3



Eccentric flat channel venturi

FIG. 4

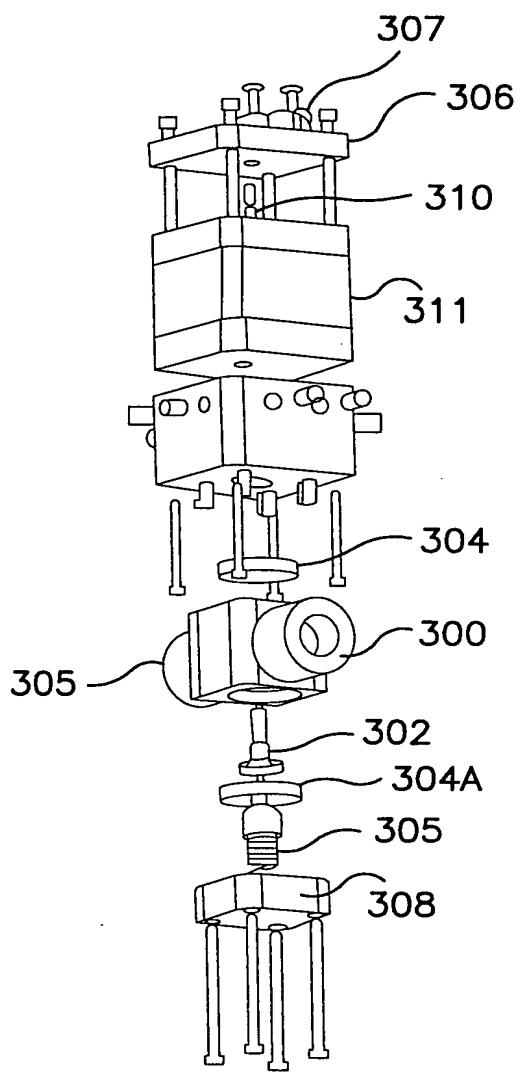


FIG. 5

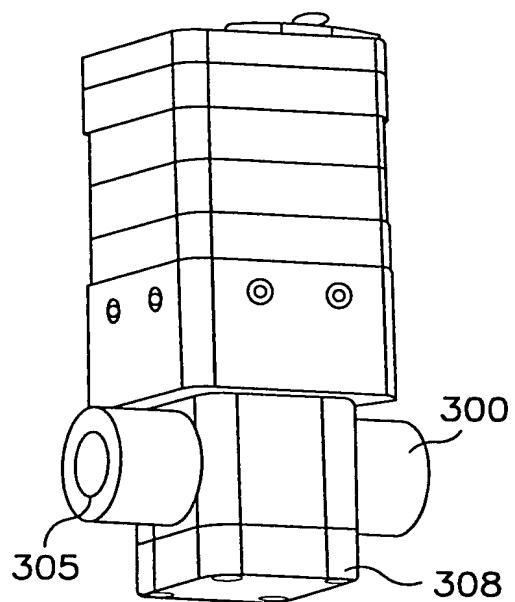


FIG. 6

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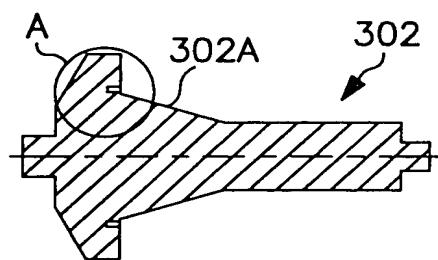


FIG. 7

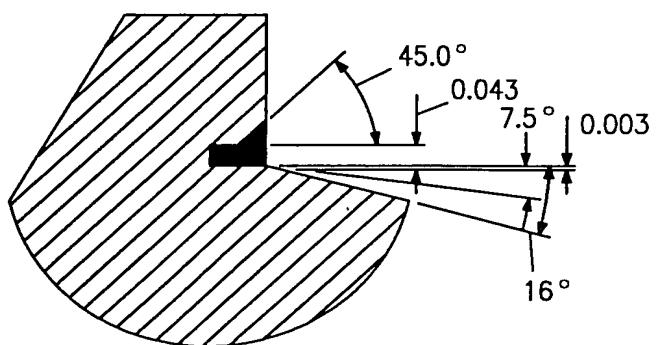


FIG. 7A

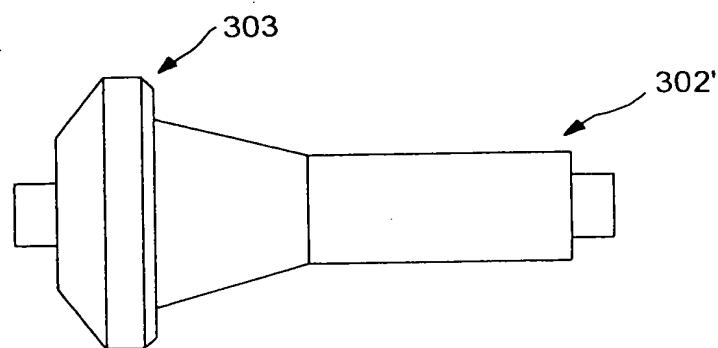


FIG. 8

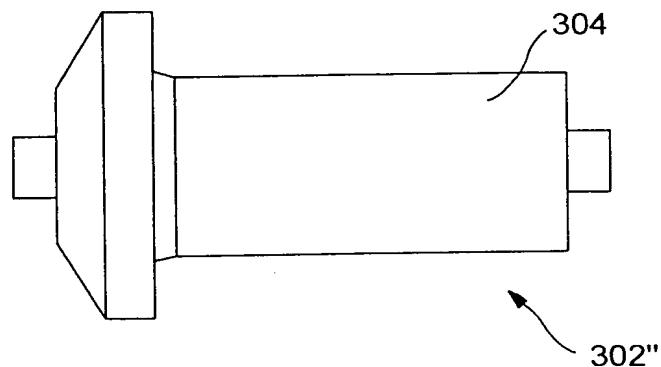


FIG. 9

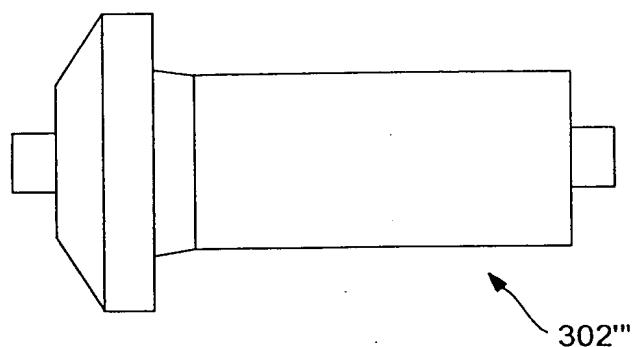
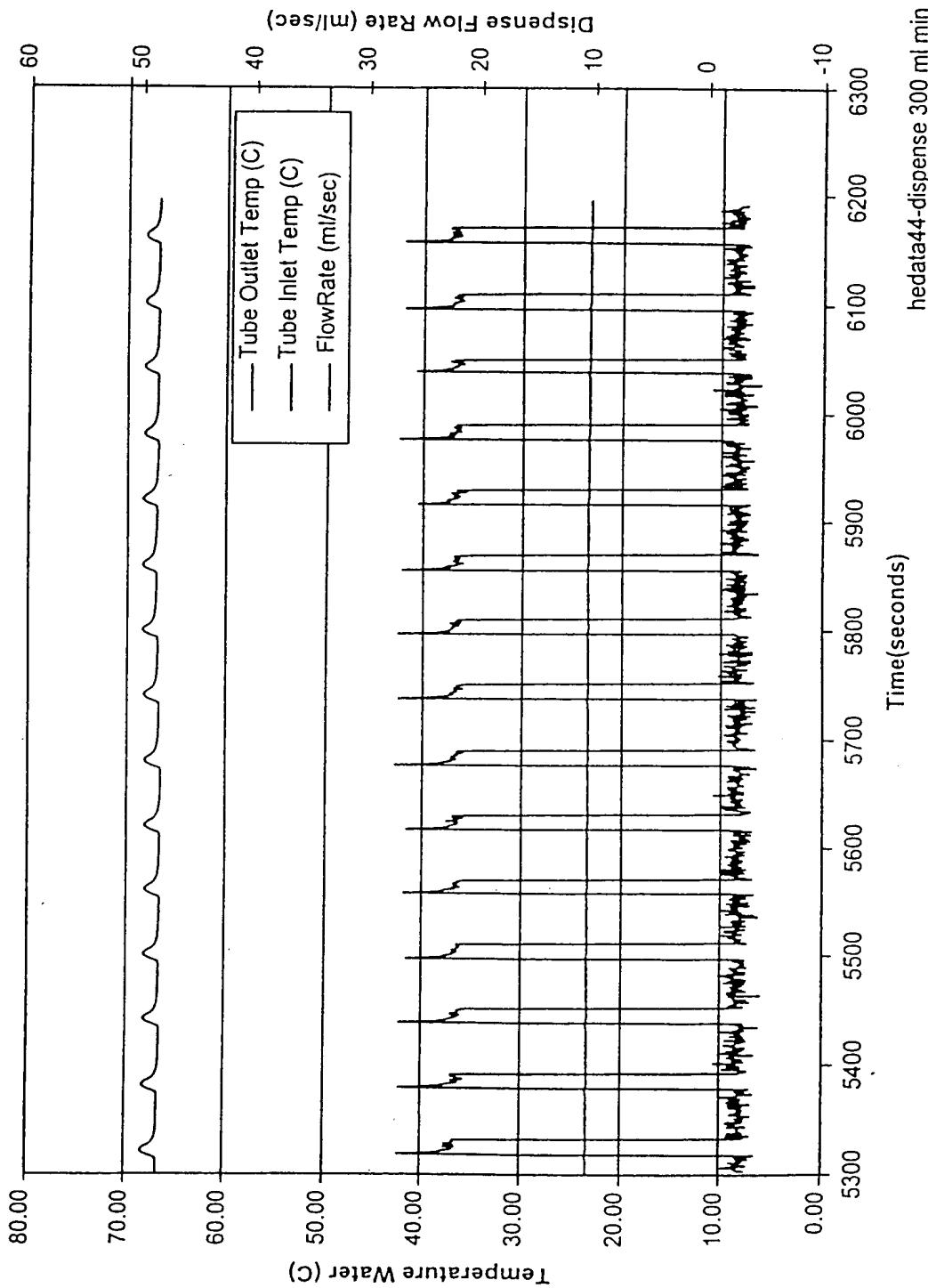


FIG. 10

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Heat Exchanger (5265-65-3): Shell ID = 2.25 in, Length = 18 in
Shell (HOT) Flow = 1460 ml/min; 70+/-0.1 C
300ml total dispense dispense volume @ 67.4+/-0.9C in 15 sec; off cycle 45 seconds



hedata44-dispense 300 ml min 18 inch unit.xls

FIG. 11

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Heat Exchanger: Shell ID = 2.25 in, Length = 8 in
Shell Flow = 500 ml/min @ 27.1 C
Tube Flow = 1150 ml/min; Cycle 5 seconds on, 10 seconds off Dispense Volume = 100ml
Tube Inlet Temperature = 23.4 C

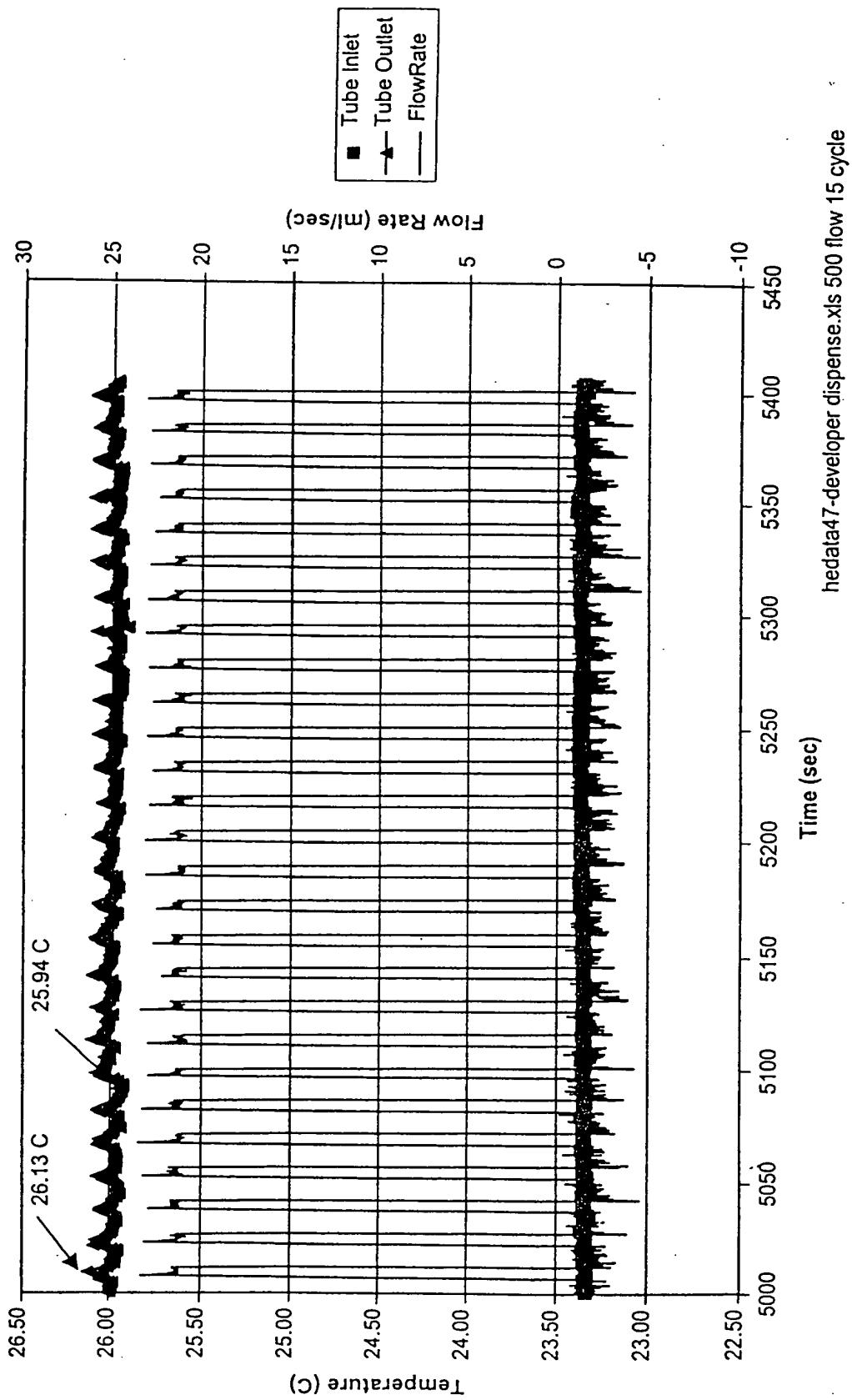
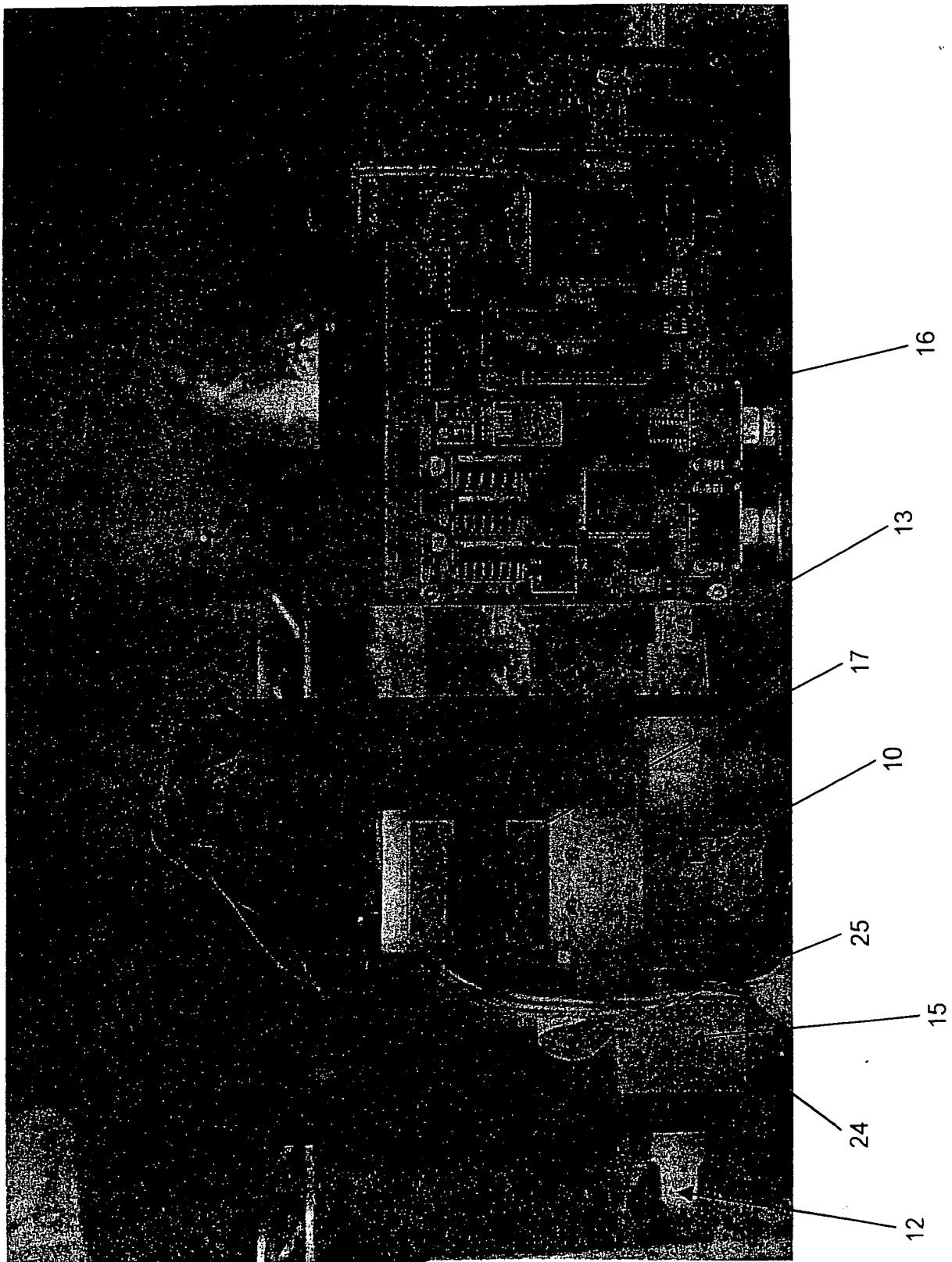


FIG. 12

hedata47-developer dispense.xls 500 flow 15 cycle

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Flute #1
0711flute1flow.xls

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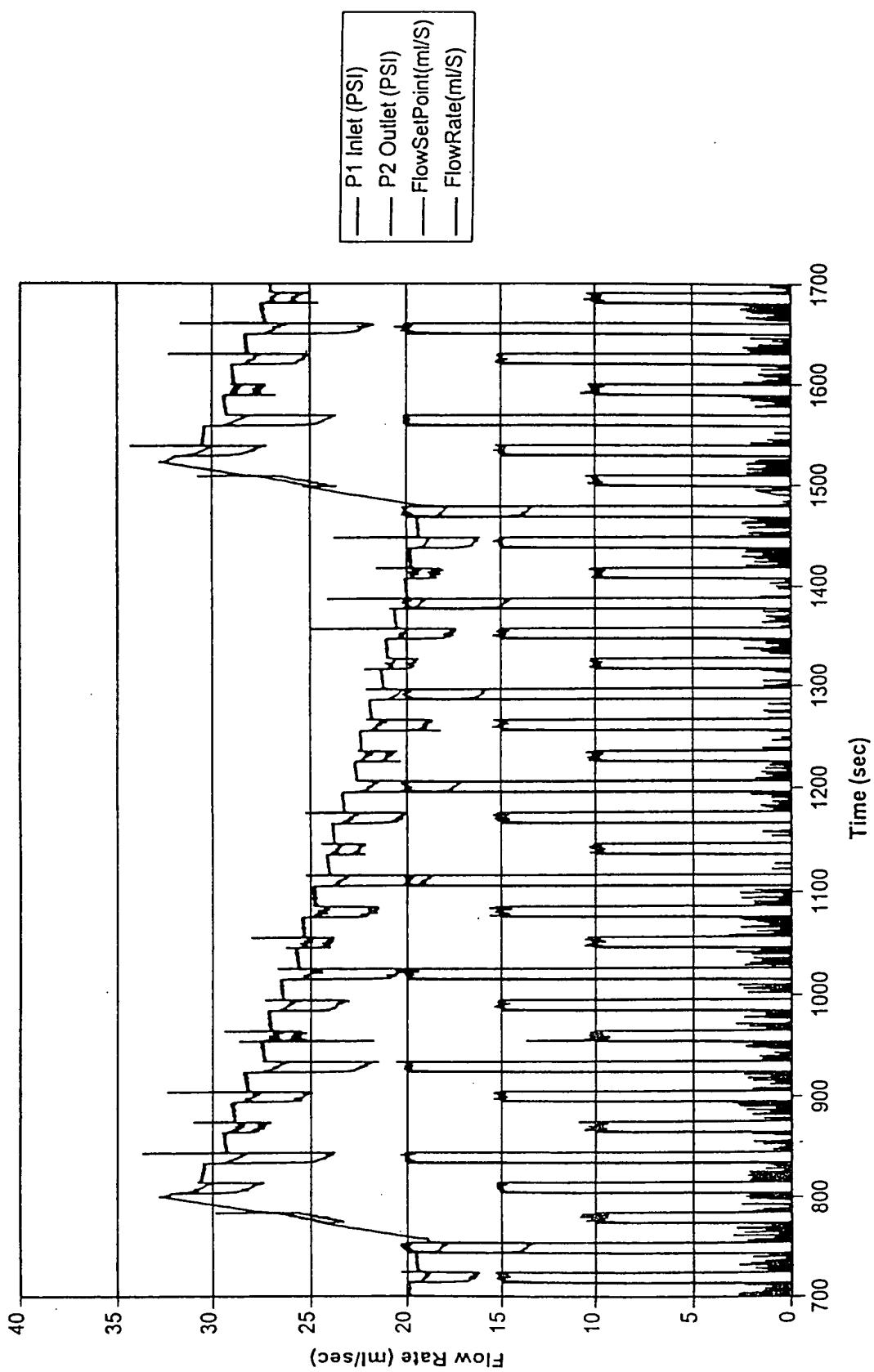


FIG. 14

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FLUTE 6UVT2 (1/4") VOLUMETRIC FLOW RATE vs PRESSURE DROP

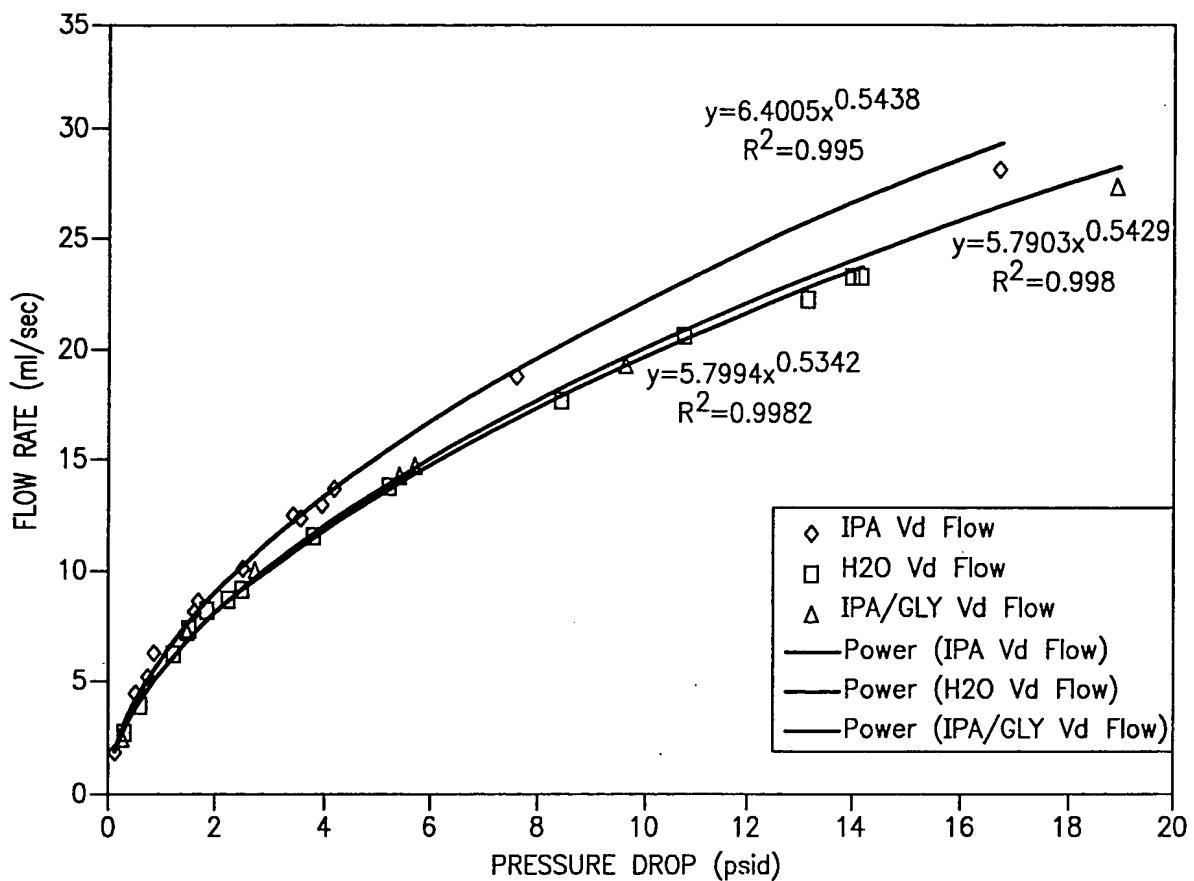


FIG. 15

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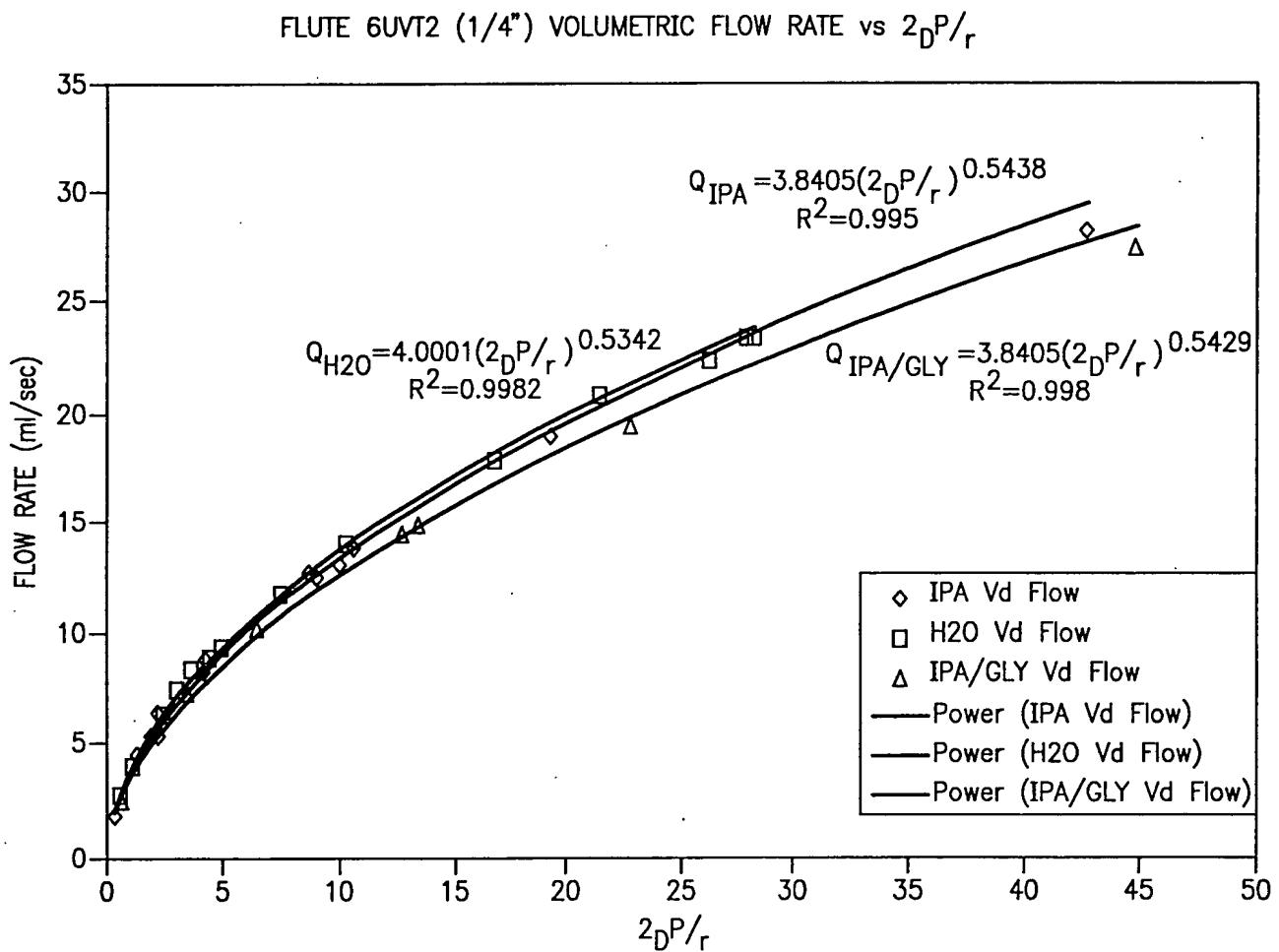


FIG. 16

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CALIBRATION CURVE COEFFICIENT C' vs KINEMATIC VISCOSITY FOR FLUTE 6UVT2
(1/4")

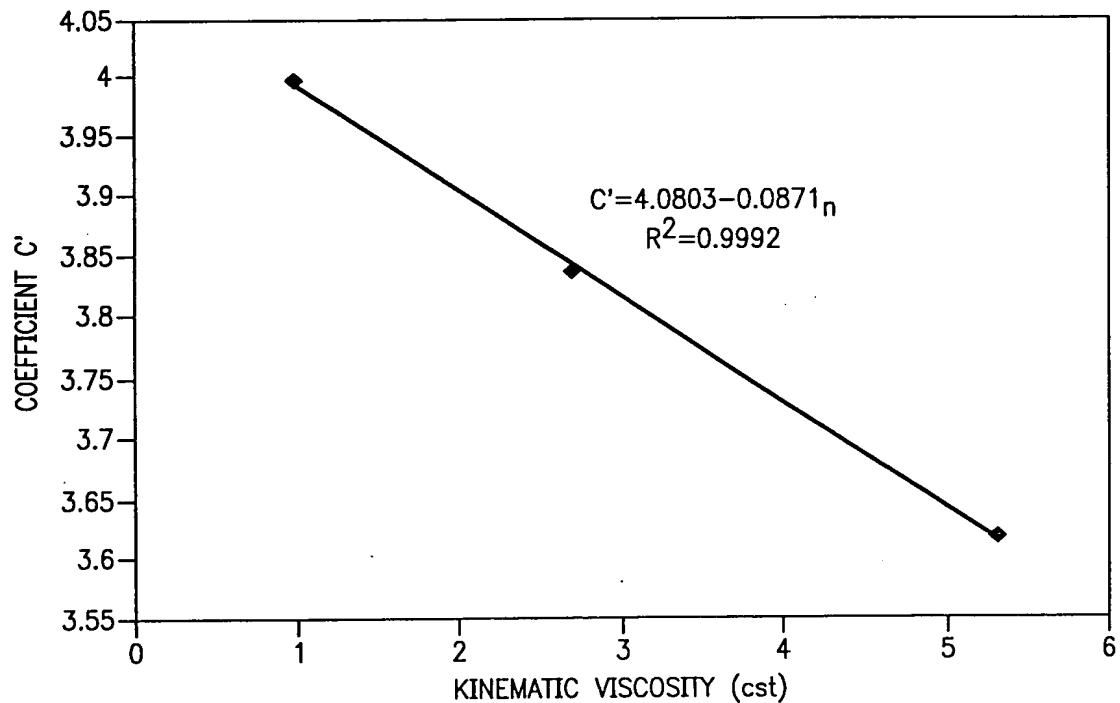


FIG. 17

FLUTE 6UVT2 (1/4") FLOWMETER CONSTANT 'K'

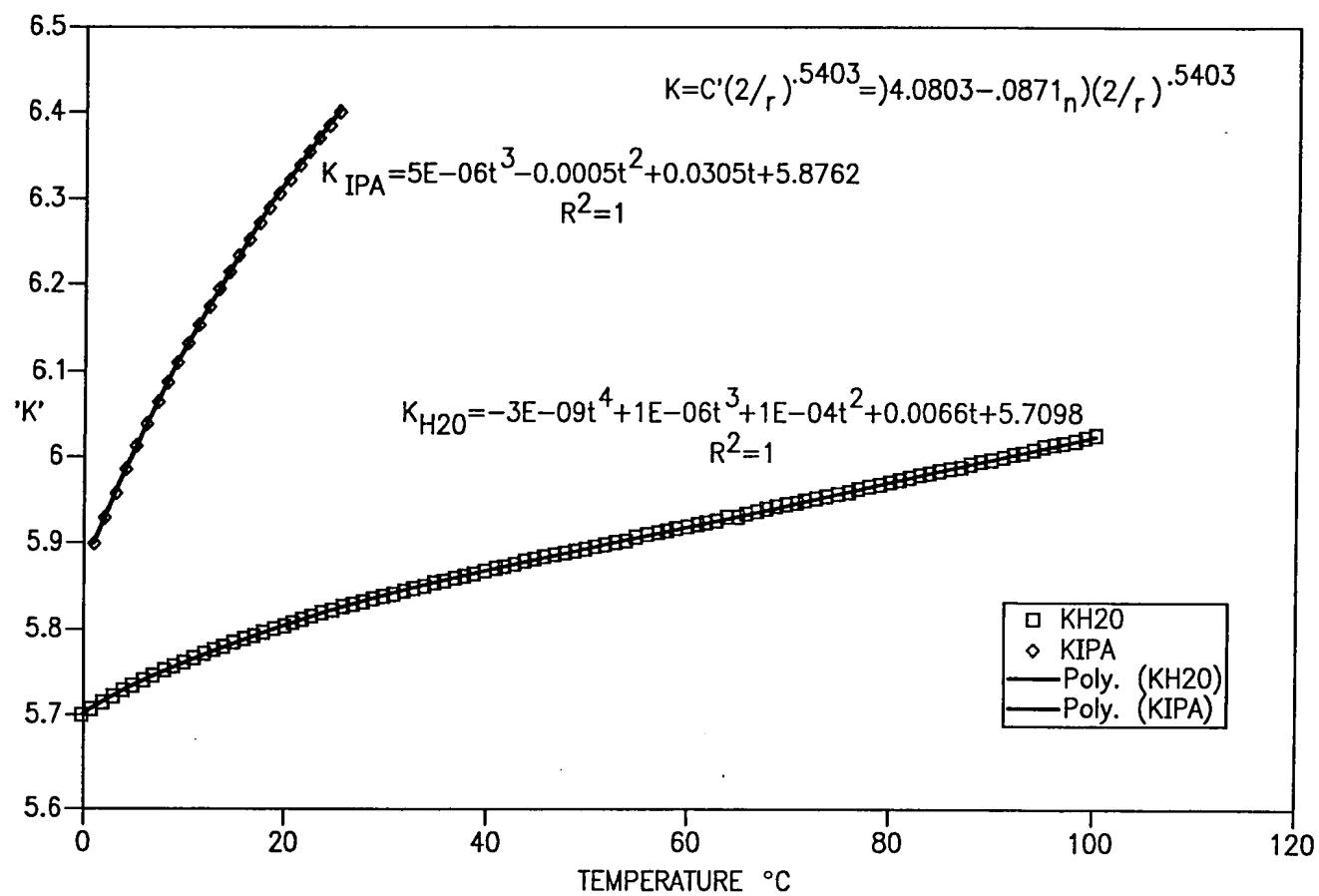


FIG. 18

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VOLUMETRIC FLOW RATE vs PRESSURE DROP FOR FLUTE 6UVT2 (1/4")

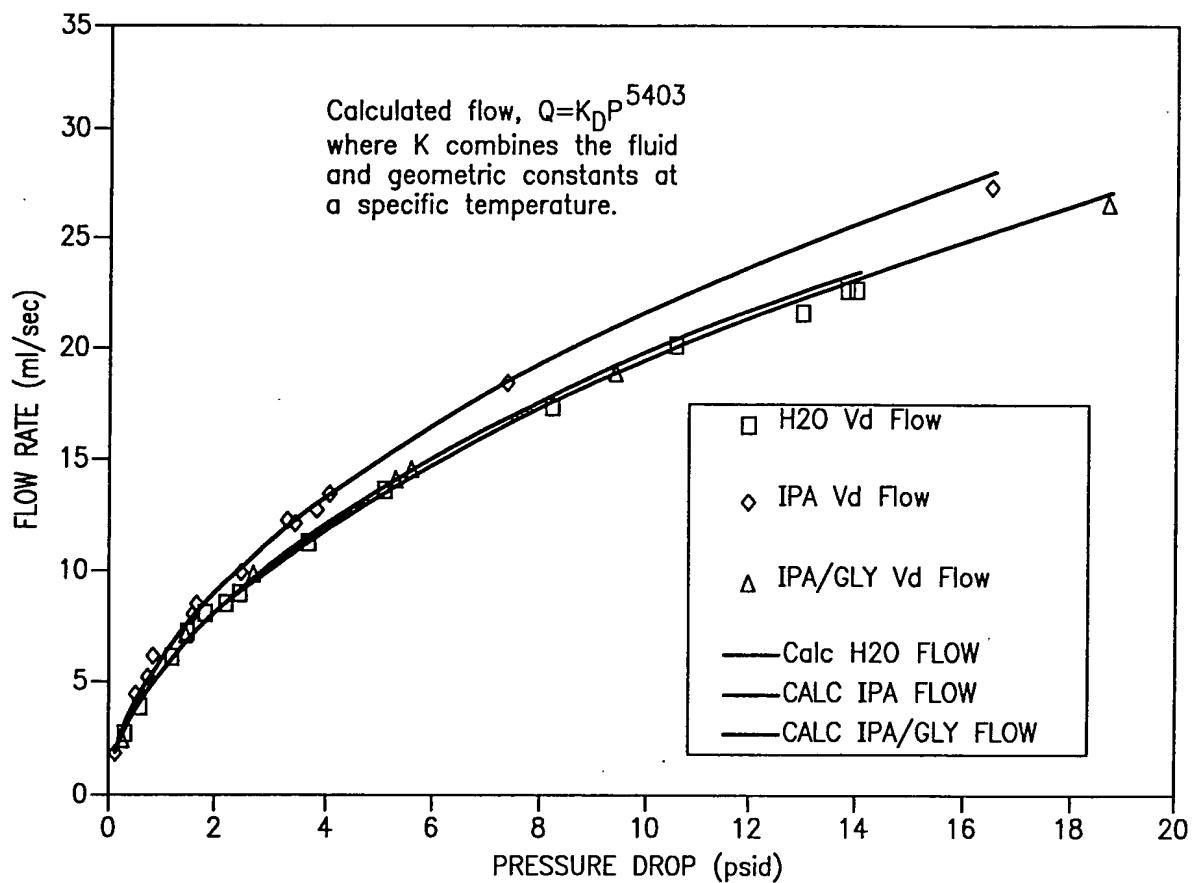


FIG. 19

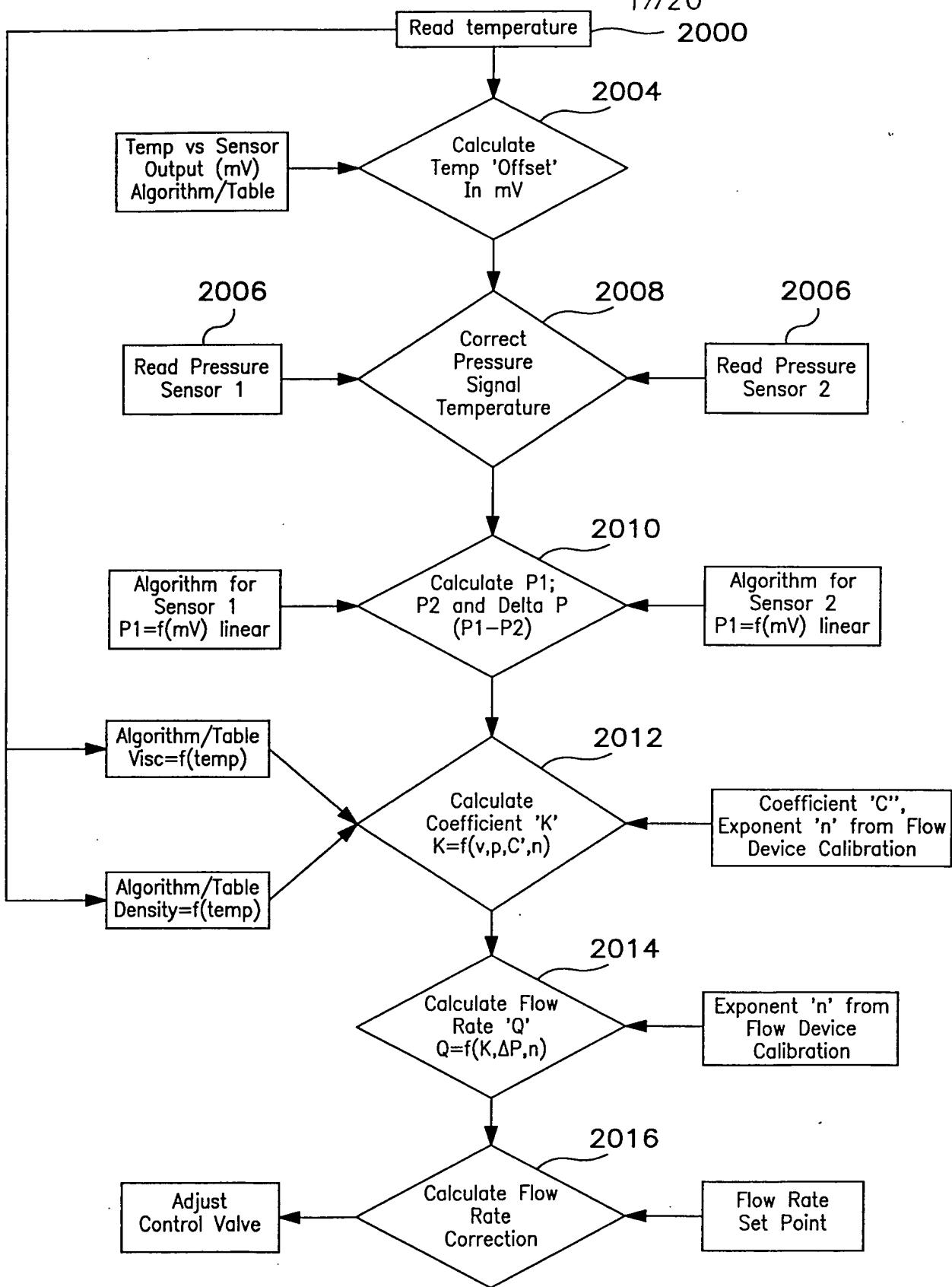


FIG. 20

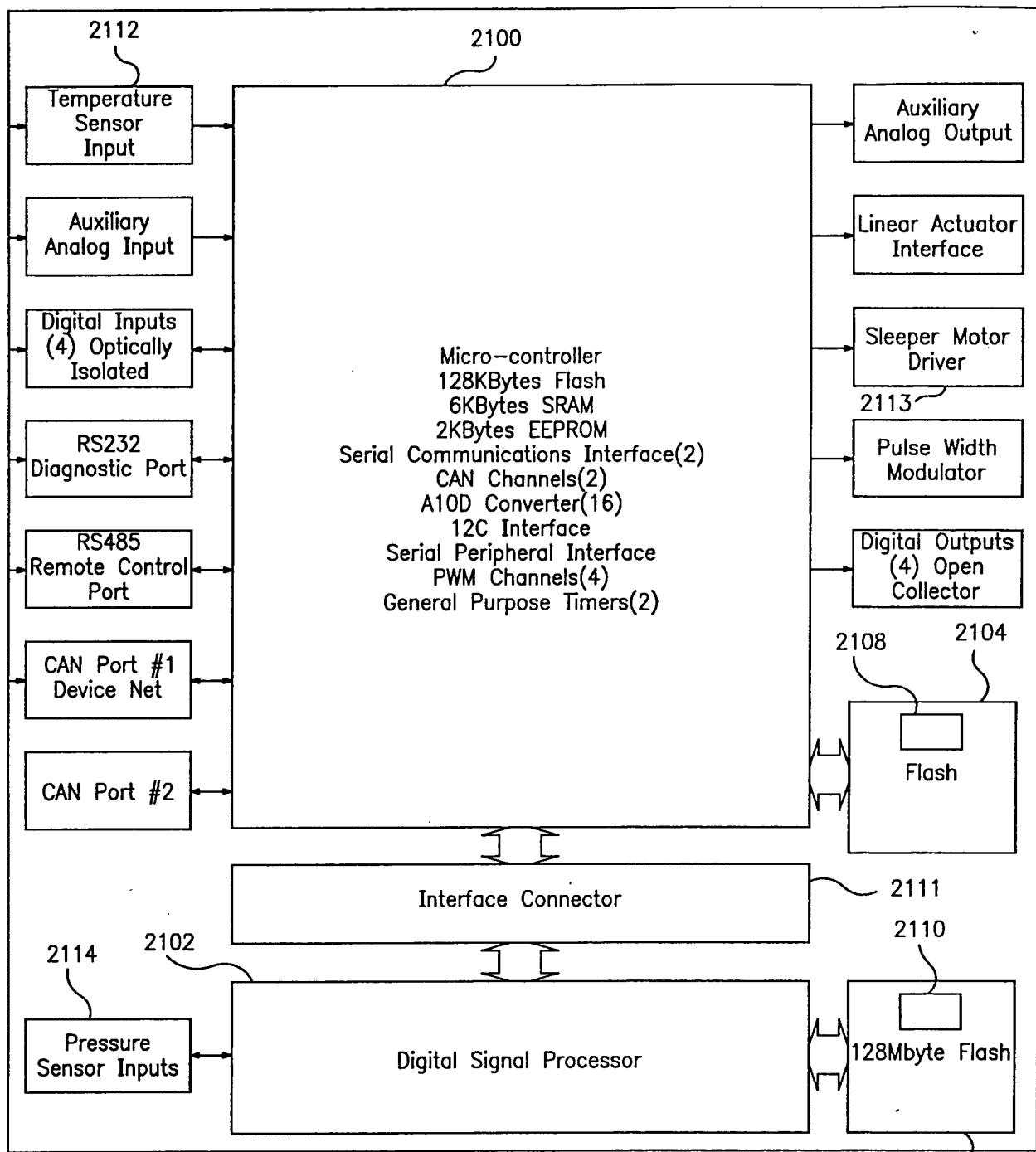


FIG. 21

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As long as the fluid speed is sufficiently subsonic ($V < \text{mach } 0.3$), the incompressible Bernoulli's equation describes the flow. Applying this equation to a streamline traveling down the axis of the horizontal tube gives,

$$p_a - p_b = \Delta p = \frac{1}{2} \rho V_b^2 - \frac{1}{2} \rho V_a^2$$

From continuity, the throat velocity V_b can be substituted out of the above equation to give,

$$\Delta p = \frac{1}{2} \rho V_a^2 \left[\left(\frac{A_a}{A_b} \right)^2 - 1 \right]$$

Solving for the upstream velocity V_a and multiplying by the cross-sectional area A_a gives the volumetric flowrate Q ,

$$Q = \sqrt{\frac{2\Delta p}{\rho}} \frac{A_a}{\sqrt{\left(\frac{A_a}{A_b} \right)^2 - 1}}$$

Ideal, inviscid fluids would obey the above equation. The small amounts of energy converted into heat within viscous boundary layers tend to lower the actual velocity of real fluids somewhat. A discharge coefficient C is typically introduced to account for the viscosity of fluids,

$$Q = C \sqrt{\frac{2\Delta p}{\rho}} \frac{A_a}{\sqrt{\left(\frac{A_a}{A_b} \right)^2 - 1}}$$

FIG. 22

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